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## REVIEWS.

### CRYSTALLINE ROCKS FROM THE ANDES.

*Untersuchungen an altkrystallinen Schiefergesteinen aus dem Gebiete der argentinischen Republik* von B. KÜHN. Neues Jahrbuch für Min., etc., Beit. Bd. VII., 1891, p. 295,

*Untersuchung argentinischer Pegmatite, etc.*, von P. SABERSKY, *ib.* p. 359.

*Untersuchungen an argentinischen Graniten, etc.*, von J. ROMBERG, *ib.*, VIII., 1892, p. 275.

TRAVELERS and foreign residents in South America are rapidly furnishing information relative, not only to the volcanic, but also to the older crystalline rocks composing the great Andes chain. Since the early observations of Darwin,<sup>1</sup> the petrographical collections made by Stelzner during his three years' residence, as professor, at Cordova (1873–1876) have been described by himself<sup>2</sup> and Franke,<sup>3</sup> while the results of detailed studies of the more extensive collections gathered by Stelzner's successor, Professor L. Brackebusch, are now beginning to appear. Professor Brackebusch's residence in the Argentine Republic lasted from 1876 till 1883, and during this period he made numerous scientific expeditions.<sup>4</sup> The petrographical material thus obtained has been confided to specialists in Germany for study. Three papers dealing with the crystalline schists (gneisses),<sup>5</sup> pegmatites,<sup>6</sup> and granites,<sup>7</sup> have recently appeared. The rocks of the granite contact-zones

<sup>1</sup> Geological Observations in South America, 1846.

<sup>2</sup> Beiträge zur Geologie und Paleontologie der argentinischen Republik; I. Geologischer Theil, 1885.

<sup>3</sup> Studien über Cordillerengesteine. Apolda, 1875.

<sup>4</sup> Reisen in den Cordilleren der argentinischen Republik, Verh. der Gesellsch. für Erdkunde. Berlin, 1891.

<sup>5</sup> Untersuchungen an altkrystallinen Schiefergesteinen aus dem Gebiete der argentinischen Republik, von B. Kühn. Neues Jahrbuch für Min., etc., Beit. Bd. VII., 1891, p. 295.

<sup>6</sup> Untersuchung argentinischer Pegmatite, etc., von P. Sabersky, *ib.*, p. 359.

<sup>7</sup> Untersuchungen an argentinischen Graniten, etc., von J. Romberg, *ib.*, VIII., pp.

had been placed in Professor Lessen's hands before his death, while communications on other special groups are doubtless to be expected.

These investigations naturally suffer from the forced absence of all field observations on the part of their authors, but the purely petrographical study of the material brings to light many points of interest, while it furnishes the only sort of detailed information regarding the rocks of these remote regions which we can for the present hope for. It is here desired only to direct attention to a few of the most striking results obtained from the Brackebusch material by the three authors last cited.

Dr. Kühn's paper on the crystalline schists treats principally of gneiss, and offers little that is new. It is mostly occupied with additional evidence of structural and chemical changes due to dynamic metamorphism in the sense of Lehmann. The most noteworthy of these are development and microstructure of fibrolite; production of augen-gneiss from porphyritic granite; development of microcline structure in orthoclase by pressure; secondary origin of microcline, microperthite and micropegmatite; alteration of garnet to biotite and hornblende.

Dr. Sabersky's paper on the coarse-grained granites or pegmatites is entirely mineralogical, and is devoted principally to elucidating the structure of microcline. The author concludes that the well-known gridiron structure is due, not to two twinning laws (the Albite and Pericline), as has been generally supposed, but to the Albite law alone, in accordance with which the individuals form both contact and penetration twins, like the albite crystals form Roc-tourné, described by G. Rose.

Dr. Romberg's paper on the Argentine granites is much more extensive than the two preceding. It is embellished by seventy-two microphotographs, many of which admirably illustrate the special points described. He comes to several results of great petrographical significance, the most important of which relate to the origin of quartz-feldspar intergrowths in granitic rocks. He clearly shows that beside the original granite quartz there is also much of a secondary nature present. This is not microscopically distinguishable from the original mineral, but its later genesis is demonstrated by many careful observations on its relation to other constituents. The abundant secondary quartz is regarded as the product of weathering—principally of the feldspar, into which it has a peculiar tendency to penetrate. The

extreme sensitiveness of quartz to pressure is emphasized (as it has been by Lehmann and the present writer) and illustrated by undulatory extinction, banding, granulation and even plastic bending around other minerals. Dynamic action is regarded as the efficient cause of the secondary impregnation of feldspar by quartz, and a union of this with weathering of the feldspar as the source of the abundant and complex pegmatitic intergrowths of quartz and feldspar.

These results are important, and they will now doubtless come to be generally recognized. It is, however, of interest to observe in this connection that all which is here announced as new in regard to secondary and "corrosion" quartz was described and figured in even greater detail by Prof. R. D. Irving ten years ago. This does not appear to be known to Dr. Romberg, for he does not allude to it, but anyone who will turn to pages 99 to 124 and plates XIII, XIV and XV of the monograph on the Lake Superior Copper Rocks (vol. 5, U. S. Geol. Survey, Washington, 1883) will find his conclusions stated in almost the same language and with a much wider range of fact and illustration. Dynamic action is not here adduced as a cause for the saturation of feldspar by secondary micropegmatitic quartz, since the Lake Superior rocks show no evidence of having been subjected to pressure, but that the quartz itself has been derived from the leaching of the feldspar substance and that the impregnation is mostly confined to the orthoclase is clearly stated.

Dr. Romberg also demonstrates, in a number of cases, the secondary origin of albite, especially as microperthite, and of microcline. He gives details relating to each of the mineral constituents, and then the effects of pressure and of chemical action on the most important of them. Among many interesting observations but a few can be even mentioned here; such, for instance, as the original character of muscovite in many granites; the alteration of garnet into muscovite; the dependence of the well-known pleochroic halos in biotite and cordierite upon the substance of the zircon which they almost invariably surround, and secondary rutile needles which grow out from biotite into both quartz and feldspar. In one rock occurring in a granite a violet, strongly pleochroic mineral was found, which, in neither composition nor physical properties, agreed exactly with any known species. It seems to be intermediate between andalusite and dumortierite, but, as its individuality is not yet perfectly established, no new name is proposed for it.

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